ECONOMIC POTENTIALS FOR BALING WOOD SHAVINGS AND SACKING SAWDUST

In Four Western Resource Conservation and Development Project Areas

ERS-335
Economic Research Service
U. S. Department of Agriculture

PREFACE

This study is a part of the Resource Conservation and Development Projects Program of the U. S. Department of Agriculture. It was carried out in accordance with a Memorandum of Understanding between the Economic Research Service and the Soil Conservation Service, December 1963. The study has benefited from cooperation of State and local governments, universities, and industry people. In particular, appreciation is expressed to the Oregon Forest Products Laboratory, Forest Economics Section of the University of Idaho, Forest Products Co., Unitah Planing Mill and the Kamas Valley Lumber Co.

CONTENTS

Washington, D. C. March 1967

SUMMARY

Demand exists for baled shavings and sacked sawdust produced by lumber byproduct processing firms in many areas of the West. Poultry producers use large quantities of shavings and sawdust for litter, and cattle producers and mink ranchers employ this material for bedding. Butcher shops, garages, and certain packing plants require it for special purposes. In addition, baling and sacking operations contribute to community environment by reducing air pollution in some Western lumber regions.

Major factors to consider before investing in a baling or sacking firm are the supply of raw materials and the potential area demand. The firm should be assured of a continuing raw material supply to meet the plant's requirements. At present, firms in Utah are unable to meet the demand for baled shavings, principally because of an inadequate raw material supply. Potential demand should be analyzed thoroughly to determine the amount of finished product that could be sold. If demand exceeds the raw materials supplied by one mill, the firm may be wise to locate centrally for collection of raw materials from two or more mills.

Since only one firm with a wood shavings-baling operation was located in the Research Conservation and Development (RC&D) study areas, numerous baling and sacking firms in or near Salt Lake City were analyzed for this report. The data obtained from these firms, however, are applicable to the four RC&D areas under consideration.

Among the firms studied for this report, capital investment in any separate type of processing operation did not exceed $15,000, or $19,000 when the sawdust sacking and shavings baling functions were combined. This investment is nominal compared to most small businesses.

A converted hay baler may be used to bale shavings, an operation which was budgeted in this report at a capacity net return of $1,076, or 2.8 cents per bale. A firm could operate at less than capacity if price received per bale was higher, or if the cost of raw materials was lower, than those used in the analysis. Otherwise, very little, if any, net return would be possible at lower production levels.

Balers specially manufactured to bale wood shavings were budgeted to give a net return of $8,695, or 13 cents per bale, when operated at capacity (67,200 bales annually). This capacity operation would require shavings from a mill with an annual output of 15 million board-feet of lumber. Lacking sufficient raw materials, a firm could perform a baling operation at one-third of capacity, which would give an annual net return of $1,343.

A sawdust sacking operation at capacity (192,000 sacks annually) would provide a net return of $19,254, or 10 cents per sack. However, raw material from a mill with a large lumber output would be needed to support this full operation. Functioning at one-third of capacity, a sawdust sacking firm would net about $4,725, or 7 cents per sack.

The functions of baling shavings and sacking sawdust can be incorporated into the operations of one firm to utilize all fine wood residue. Both operations producing at capacity would yield a net return of $28,840 annually; functioning at one-third of capacity, the firm would have a net return of $5,579.

Net return of either sacked sawdust or baled shavings can be increased through product differentiation, which involves separating the residue by coarseness. Also, discriminative pricing (for example, labeling white pine

shavings as "mink bedding") may add to profits.

Clearly, baling shavings and sacking sawdust in areas where lumber by-products and residues have not been used may add materially to returns from the lumber industry and benefit the local economy.

ECONOMIC POTENTIALS FOR BALING WOOD SHAVINGS AND SACKING SAWDUST

In Four Western Resource Conservation and Development Project Areas

by
J'Wayne McArthur and Glenn Warnick 1/

INTRODUCTION

Farmers in the Idaho-Washington Resource Conservation and Development (RC&D) project and the surrounding Palouse area are finding it more difficult each year to obtain an adequate supply of straw for livestock bedding. This bedding shortage is due in large part to the adoption of the new Gaines variety of wheat, which has a shorter stem than preceding varieties. This stem is shortened further during combining, which leaves little to mow and bale. Some farmers are not attempting to bale this short stand. Increased production of peas and lentils in place of straw-producing cereal grains is another factor in the decreasing supply of straw.

Livestock men realize wood shavings and sawdust are good substitutes for straw. Some farmers are now hauling these wood byproducts in bulk, paying 1 1/2 to 2 1/2 cents per cubic foot for combined sawdust and shavings. Since this product is too bulky for extensive storage on the farm, frequent trips to the mill are required.

Farmers in the Idaho-Washington RC&D project have requested the Economic Research Service to determine the feasibility of installing a plant to bale shavings and pack sawdust. Farmers in other areas, including three other RC&D projects in the Western States (Upper Willamette Project in Western Oregon, Upper Rio Grande Project in Northern New Mexico, and the Bitter Root Project in Western Montana), are making similar requests.

Lumber mills scattered throughout all four of the RC&D projects have an abundant supply of sawdust and shavings that for the most part is not being used. Some firms send part of their shavings and sawdust to pulp mills, while others burn these byproducts. A small percentage of the sawdust and shavings is sold loose to farmers. In all four RC&D areas, livestock and poultry producers appear willing to buy baled shavings and sacked sawdust at a price competitive with straw. Some farmers would pay a premium because they believe shavings and sawdust are better than straw for bedding and litter.

PROCEDURE

Only one firm with a wood shavings-baling operation was located in the RC&D areas. The firm was new, however, and had no cost-of-production data; therefore, data had to be obtained outside the RC&D areas.

1/ Respectively, Agricultural Economist and Economic Assistant, Natural Resource Economics Division, Economic Research Service.

Seven firms baling and/or sacking wood residue in Salt Lake City and neighboring areas were interviewed. Planing mills in the Salt Lake City metropolitan area are prohibited from burning wood residues, so some of these firms sell loose shavings and sawdust, while others have baling and sacking operations.

Data obtained from these firms were analyzed. Budgets were then developed for four distinct types of operations: converted hay baler, specialized shavings baler, sawdust sacking, and combined baling and sacking.

Producers of livestock and poultry were contacted concerning the use of shavings and sawdust versus straw. Market data and ideas for this report were obtained from operators of livestock packing plants, auctions, nurseries, and other firms.

Information concerning the supply of raw materials was obtained from the Oregon Forest Products Laboratory and personnel of the Forest Economics section of the University of Idaho.

RAW MATERIALS

Current expectations are for a significant future increase in the demand for forest products in the United States. Present projections anticipate the demand for pulpwood alone tripling between 1962 and the year 2000 (5). 2/ The amount of plant byproducts at sawmills, veneer mills, and other wood-using plants has increased in recent years and in 1962 totaled about 9 million cords in the United States. About 20 percent of the total U. S. pulpwood was obtained from plant byproducts in 1962. In the same year, unused coarse residues 3/ at primary manufacturing plants amounted to an estimated 4.5 million cords of softwoods and 2.3 million cords of hardwoods, and unused fine residues 4/ were estimated at 7.3 million cords of softwoods and 2.9 million cords of hardwoods.

Not all residues are economically available for pulping. Shavings and sawdust are frequently not acceptable for pulp because the fibers are too short. With increased activity in the wood industry, however, more residues will be used for pulp, although a large amount of residue throughout the United States will still be available for livestock bedding as well as other uses.

Within the four western RC&D projects, it is estimated that at least 50 percent of the wood residues are not used. Oregon has the lowest unused percentage because increasing amounts of residue are going into pulp.

When firms in Idaho and Oregon were grouped by volume of production, firms in the largest group produced about 5 million board-feet (MMbf) of lumber annually (1, 2, and 6). Production per mill in the project areas ranges from less than 1 to 20 MMbf annually.

To estimate the potential of a baling or sacking firm adjacent to a given mill, the quantity of raw materials available must be determined first. Table 1 shows the breakdown of a log into its components by volume and weight. Tables 2 and 3 show the conversion from tons of residue to bales of shavings

---

2/ Underscored numbers in parentheses refer to items in Literature Cited, page 23.

3/ Slabs, edgings, and timber trim.

4/ Sawdust, shavings, and bark.

and sacks of sawdust. 5/ These estimates are based on dry weight. The actual material has some moisture in it not accounted for here. Much of the difference may be taken up by wastage and residues used for fuel.

Table 1.--Average residues derived from lumber manufacture, western Oregon, 1953

Item	Solid volume	Dry weight
	Cubic feet 1/	Tons 1/
Wood residue:		
Coarse residue	32.1	0.443
Sawdust	20.5	0.283
Shavings	15.0	0.207
Bark	20.8	0.287
All residue	88.4	1.220
Lumber	69.1	0.954
Whole log	157.5	2.174

1/ Per 1,000 board-feet of lumber.
Source: (1).

Table 2.--Average dry weight of residues derived when producing 1,000 board-feet of lumber, western Oregon, 1953

Item	Species		
	Douglas fir	True firs, cedars	Pine
	Tons	Tons	Tons
Coarse residue	0.45	0.35	0.31
Sawdust	0.28	0.22	0.26
Shavings	0.21	0.16	0.11
Bark	0.29	0.22	0.28

Source: (1).

5/ Tables 1 to 3 present data for 1953. Later data for these items are not available.

Table 3.--Average bales of shavings and sacks of sawdust which could be accrued from residue developed when producing 1,000 board-feet of lumber, western Oregon, 1953 1/

Species	Shavings	Sawdust
	Bales 2/	Sacks 3/
Douglas fir	5.2	18.7
True firs, cedars	4.8	14.7
Pine	2.8	17.3

1/ Data calculated from tonnages in table 2.
2/ A bale weighs 80 pounds.
3/ A sack weighs 30 pounds.

The conversion factors used in tables 1 through 3 are averages. Residue developed varies between and within sawmills and with log size, log quality, size and kind of lumber produced, and type of sawmill equipment operated.

The prices charged for raw materials in the budgets used in this analysis are set higher than the presently quoted price of $3 per ton. This adjustment includes procurement costs and offsets added demand that may develop for use of these raw materials as pulpwood. Where the residue is presently being burned, little additional cost would be incurred by blowing the residue into a building located near the burner. Location of the mill near the blower equipment is a least-cost method of procurement and would cut the cost of raw material below the $6 budgeted.

In many instances, a baling and sacking operation would reduce air pollution. In cases where firms are required to control air pollution, a mill could benefit by establishing a baling and sacking operation.

POTENTIAL MARKETS

Poultry producers use large quantities of dry shavings and sawdust for litter. Since these residues absorb more moisture per unit than straw, their use decreases the amount of litter needed, and most producers consider them more economical than straw.

Changing cattle management programs and seasonal demands affect the quantities and types of bedding used. The shift from lounging sheds to individual stalls for dairy cows decreases but does not eliminate bedding requirements. Furthermore, some beef cattle producers bed their livestock in the winter while they are in drylot. In all four project areas, heavy winter precipitation creates a need for bedding cattle which are in drylot. Fortunately, shavings and sawdust are plentiful in these areas. Presently, some fine wood residues are being purchased loose by farmers, although baled or sacked material could be handled more easily.

Mink ranchers use shavings for bedding mink, since this material will stay in the mink boxes longer than other materials available. The main species of wood used is white pine. Some other species, fur breeders claim, discolor the pelts.

Some farmers do not use wood byproducts for bedding and litter because they believe applying the bedding and manure to the soil will be harmful to the following crop. However, according to a USDA publication, "Woods and barks, with few exceptions, can be used satisfactorily in agriculture as mulches, and for soil humus maintenance, if adequate amounts of nutrients, especially nitrogen and sometimes lime are supplied. Most woods behave similarly to common carbonaceous crop residues, except that they decompose more slowly because they contain less available carbohydrates and more lignin." (4)

Other users of shavings and sawdust include auction barns, livestock packing plants, butcher shops, garages, and construction firms. Sawdust or shavings can be substituted for straw in nearly any use.

Many homeowners are using wood residue in home beautification projects. This material can be used for mulches around flowers, or it may be added to the soil to increase humus. Wood residue can be distributed through lumber yards or shopping centers. One firm, for example, satisfied this demand by providing a self-service stand where customers can load their own sawdust, shavings, or other material of their choice from piles of loose material (figs. 1 and 2). Sacks are available if the buyer has no container.

Figure 1.--Self-service area of a firm selling old and new sawdust, shavings, bark, and topsoil.

Figure 2.--Self-service area at the same firm shown in figure 1. Fireplace wood as well as wood for fuel is available here.

Research indicates that potential sales volume and value would increase if additional outlets were developed outside the project area. Utah firms have shipped baled shavings up to 200 miles by truck. A large Ogden stockyard obtained part of its supply of shavings from California at $1.15 per bale. A cattle trucker hauled these baled shavings after delivering a load of cattle, using part of each load for bedding on the return trip to California. A meatpacker at Ogden purchased hardwood sawdust transported loose in boxcars from the Northwest.

Transportation Costs

The economic feasibility of shipping hay is a good guide in deciding whether shipping sawdust and shavings is practical, since the payload of these products is similar. Hay is frequently shipped 200 to 300 miles. Delivery to a particular place at a particular time often adds greatly to the value of sawdust and shavings, as is true with hay.

Material baled in the Upper Willamette RC&D project has a potential market in the Portland area (Washington, Multnomah, Yamhill, and Clackamas Counties), which accounted for 22 percent of the State's dairy product sales and 48 percent of the poultry and poultry product sales in 1959, according to the U. S. Census of Agriculture. A large packing industry, also located in the Portland area, is another possible market. Cost of transportation from the RC&D project area to Portland amounts to about 8 cents a bale, if shipped

on semitruck and trailer units of 15-ton payload at 30 cents per mile traveled.

Using the same cost per mile and payload as above, the cost per bale from the Idaho-Washington RC&D Project area to Spokane is 5 cents and to the Upper Columbia River Basin area (Moses Lake), 14 cents. The demand for baled material in the Spokane area comes from homeowners, packing plants, and other sources. The Upper Columbia River Basin could use a large quantity of shavings and sawdust in the agricultural industry.

The Upper Rio Grande RC&D Project area has a potential market in the Albuquerque area (Bernalillo County), which accounted for 20 percent of the State's dairy sales and 12 percent of its poultry sales in 1959. The Grants area (Valencia County) accounts for an additional 13 percent of the dairy sales and 5 percent of the poultry sales. With the same charge for transportation cited above, it costs 8 cents a bale to ship to Albuquerque and 14 cents a bale to Grants.

The Montana RC&D Project area would have to develop and expand all local markets. Possibly, firms in this area could ship to other areas in Montana, but this project area does not seem to have as large a potential demand as the other Western RC&D project areas.

Loading and unloading costs must be added to transportation costs. Unloading is usually handled by the purchaser. Much of the hand labor can be eliminated if pallets are used.

Product Differentiation

One firm observed in the Utah area capitalized on specific demands for sawdust and shavings by screening this material as it came from the planer and sacking four grades:

1. Fluff shavings were taken off by an 8-mesh screen.
2. Butcher sawdust went through the 8-mesh screen but stayed on the 14-mesh screen.
3. Garage sawdust went through the 14-mesh screen but stayed on the 26-mesh screen.
4. Wood flour sawdust flowed through the 26-mesh screen.

Fluff shavings were baled as well as sacked. The prices and weights for bagged and baled wood byproducts are shown in table 4. This firm was able to obtain very high returns from the products sold by differentiating them. Apparently, the purchasers were willing to pay a premium price to obtain the specific product they wanted.

Budgeted returns per sack and bale are much lower, however, than prices charged by this Utah firm. If differential pricing and price discrimination were used, such as pricing white pine shavings labeled "mink bedding" higher than general shavings sacked or baled for livestock bedding, firm returns might increase.

Table 4.--Prices for varied types of sawdust and shavings charged by one Utah firm, April 1, 1965

Bedding sawdust, in bulk:
Picked up minimum 100 to 299 cu. ft.----------$0.05 per cu. ft.
300 or over---------- .04
Delivered minimum 480 cubic feet---------- .05

Butcher sawdust, packed in paper bags 28-30 lb. each;
garage sawdust, packed in paper bags 32-35 lb. each:

1 to 4 bags	$0.95 per bag	20 to 124 bags	$0.75 per bag
5 to 9	.85	125 to 329	.65
10 to 19	.80	330 or over	.60

Colored green or red sawdust, packed in paper bags, weight not available:

1 to 4 bags	$1.45 per bag	10 to 19 bags	$1.20 per bag
5 to 9	1.30	20 or over	1.10

Flour sawdust, packed in paper bags 35-40 lb. each:

1 to 4 bags	$1.10 per bag	20 to 119	$0.90 per bag
5 to 9	1.00	120 to 259	.80
10 to 19	.95	260 or over	.75

Hardwood unscreened sawdust, packed in paper bags, weight not available:

1 to 4 bags	$2.10 per bag	10 to 19 bags	$1.85 per bag
5 to 9	1.95	20 or over	1.75

Fluff shavings, packed in paper bags 30-35 lb. each:

1 to 4 bags	$0.85 per bag	20 to 89 bags	$0.70 per bag
5 to 9	.80	90 to 199	.65
10 to 19	.75	200 or over	.60

Screened shavings, packed in 32-in. bales 60-65 lb. each:

	Wrapped	Unwrapped		Wrapped	Unwrapped
1 to 4 bales	$1.50	$1.35 per bale	20 to 44 bales	$1.30	$1.15 per bale
5 to 9	1.40	1.25	45 to 99	1.20	1.05
10 to 19	1.35	1.20	100 or over	1.15	1.00

All prices F.O.B. Salt Lake City, Utah. Minimum delivery 5 bags or bales. Minimum pickup 100 cubic feet. Add 10¢ per bag or bale and 1¢ per cubic foot for deliveries to points in Davis, Salt Lake, Tooele, Utah, and Weber Counties.

PLANT ANALYSIS

Costs and returns were calculated by the budget method for four types of operations: (1) Converted hay baler; (2) manufactured shavings baler; (3) sawdust sacking; and (4) combined baling and sacking. These budgets are suggested as guides. Each person interested in establishing a similar firm should calculate his own costs according to local situations.

At present, farmers in the four western RC&D project areas are paying from $12 to $20 a ton for straw. The budgets included a charge of 60 cents for an 80-pound bale of shavings, which would be equal to paying $15 a ton for straw. This charge to farmers would be realistic, considering present supply and demand for straw. Average gross return per bale in the Utah area was about 75 cents. This is higher than what might be expected in the four RC&D areas because raw materials are limited in the Utah area, and many of the bales are sold for specialized uses.

Converted Hay Baler

Some of the manufacturers contacted sold their balers in converted forms for baling a variety of materials from scrap tin to rags. It is possible to buy a baler stripped of all unnecessary parts, such as wheels, undercarriage, power-takeoff bar, and pickup and feed chamber. By eliminating these items, turning the machine on its side, and providing a power unit, the shavings baler can be constructed at an estimated cost of $2,500. This machine, with proper maintenance and repair, has an estimated life of 10 years. Annual production for this machine was estimated at about 38,400 bales, based upon 240 eight-hour working days a year at a capacity of 20 bales per hour. In addition, if this machine could be modified to tie the wire automatically instead of hand tying as is presently done, the output per hour would increase and less labor would be required.

Bales produced in a converted hay baler weigh from 60 to 110 pounds and average about 80 pounds. They are shaped according to the bale chamber dimensions, usually 16 by 18 by 30 inches, but shape varies with machine make and model.

Several balers on the used machinery market have potential for conversion, including outdated models. Stationary balers can be converted quite readily also, but they are out of production and hard to find.

The baler can be set up in a very small area, although space is needed for overhead storage of loose shavings and finished bales. A $10,000 building, estimated in the budget at a life of 25 years, would satisfy these needs. If this enterprise were incorporated into a mill with excess capacity adequate for the installation of the machine and storage, the capital investment would be markedly decreased.

Table 5 shows the budgeted costs and returns for a converted hay baler operating at full capacity. The total fixed cost for this operation was $2,029 annually, or 5.3 cents per bale. Depreciation of building and equipment amounted to about 32 percent of the total fixed costs. Administration and overhead, including advertising, secretarial service, office material, etc., amounted to about 20 percent of the total fixed cost. Fixed cost accounted for about 9 percent of the total cost of production.

Variable costs, amounting to 51.9 cents per bale, accounted for about 91 percent of the total cost. Raw materials were charged at $6 per ton. If a mill baled shavings in lieu of burning, the cost of raw materials would not be a valid charge and could be deducted from the variable costs as a benefit to the total operation.

Labor, charged at $1.50 per hour, which would be adequate for the area and type of work required, amounted to about 29 percent of the total variable cost. The machine required a 15-horsepower motor and used 12 kilowatts.

Annual maintenance and repairs were estimated at $375. Wire and wood ends cost about 10 cents per bale.

Table 5.--Budgeted costs and returns for baling wood shavings, converted hay baler operated at capacity, 1965 prices 1/

Item	Annual	Per bale
	Dollars	Cents
Total revenue	23,040	60.0
Fixed costs:		
Depreciation:		
Machine	250	.7
Building	400	1.0
Insurance	94	.2
Property tax	135	.4
Interest on investment	750	2.0
Administration and overhead	400	1.0
Total fixed costs	2,029	5.3
Variable costs:		
Raw materials ($6.00/ton)	9,216	24.0
Labor (2 men @ $1.50/hr.)	5,760	15.0
Electricity (15 H.P. motor)	744	1.9
Maintenance	375	1.0
Other materials (wire, wood ends, etc.)	3,840	10.0
Total variable costs	19,935	51.9
Total production cost	21,964	57.2
Net return	1,076	2.8

1/ 20 bales per hour capacity, 38,400 bales per year.

The total cost of baling wood shavings was $21,964 annually, or 57.2 cents per bale operating at capacity. Net return for this operation was estimated at $1,076 annually. Since these figures were budgeted from data collected in Utah, some rates may differ slightly from those in other areas, but total cost per bale should approximate those presented here. Any firm desiring to operate such an enterprise first needs to adjust these anticipated costs with those of actual inputs in the firm's area.

A firm could operate at less than capacity if price received per bale increased, or cost of raw materials decreased, from those assumed. Otherwise, very little, if any, net return would accrue to lower production levels.

Figures 3 to 7 illustrate a converted hay baler operation. Figure 3 shows the type of facilities used and the raw material feed-in pipe. In figure 4, the process of hand tying a compressed bale is shown. Wood slats are placed at each end of the bale to prevent the wires from cutting into the bale. Wooden forms which have indentations for the wires to be inserted are

placed between the bales (fig. 8). The forms should be just under bale chamber size for easy insertion.

Figure 3.--Facilities used in the production of baled wood shavings.

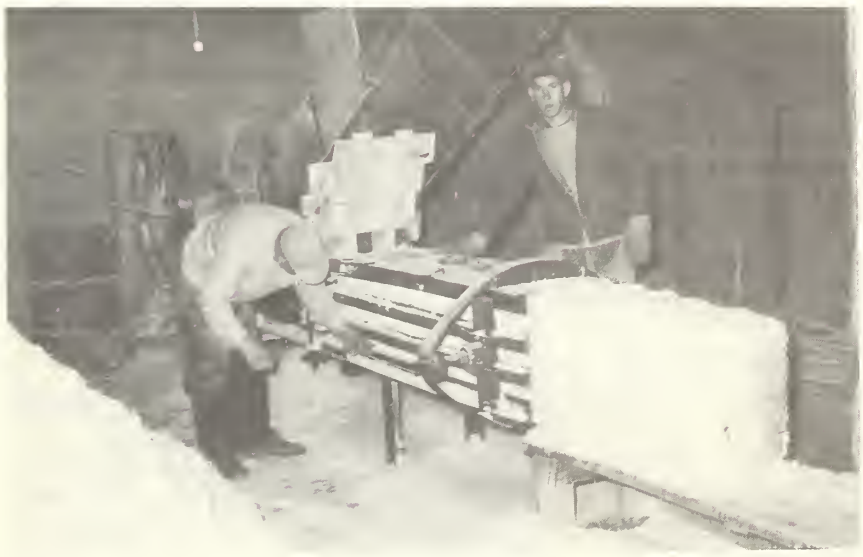

Figure 4.--Converted hay baler used to bale wood shavings.

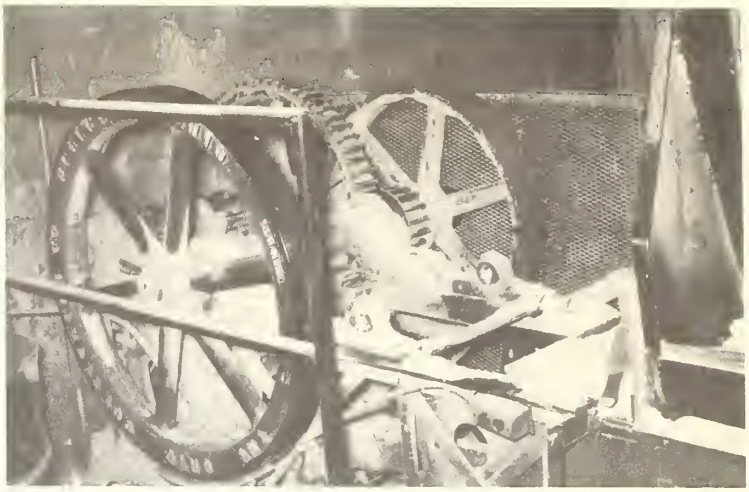

Figure 5.--Power and drive unit for converted hay baler.

Figure 6.--Baler being fed shavings from an overhead storage area.

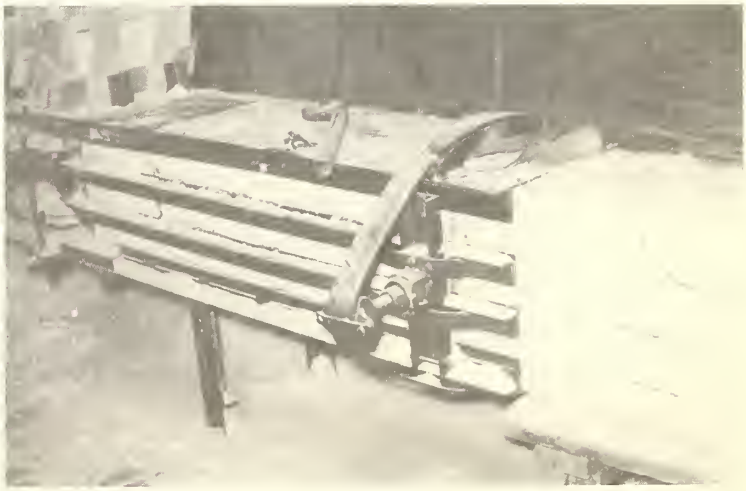

Figure 7.--Compression chamber on the converted hay baler. Within this chamber, bales are hand tied.

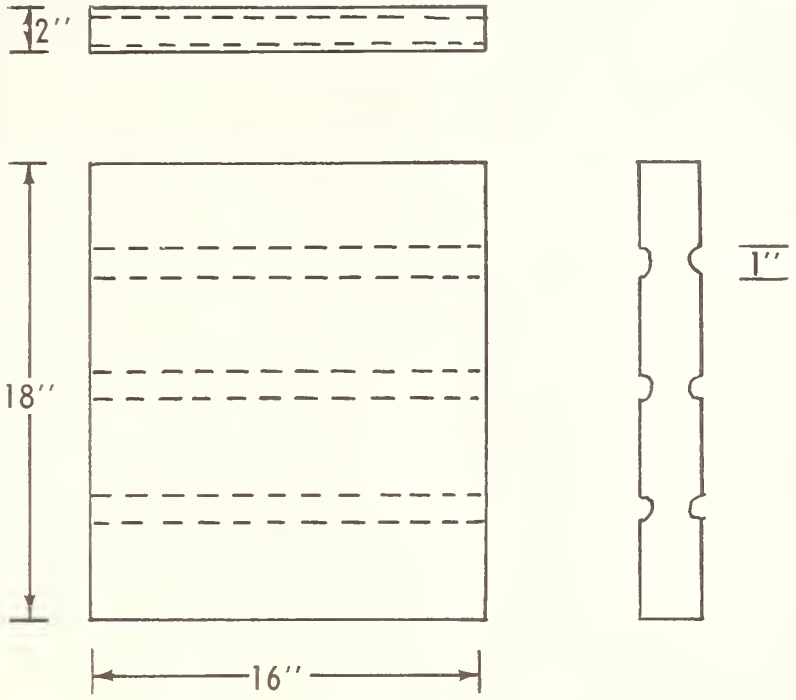

Figure 8

Specialized Shavings Baler

Some firms have machines that are specially designed and manufactured to bale wood shavings, as shown in figures 9 and 10. The bales weigh 60 to 100 pounds each depending on the type of raw material and moisture content; the average weight is about 80 pounds. These bales are held together by wood scraps at the ends tied with three wires. Figure 11 shows bales stacked on pallets for easy handling.

Capital investment in this specialized machine was $3,500: approximately $3,000 for the machine itself, $300 for transportation, and $200 for installation. Expected life of the machine was estimated at 25 years. The sum of $10,000 was allocated for facilities, since the same type of building and facilities can be used for this operation as was suggested for the converted hay baler. The total capital investment in this operation was an estimated $13,500.

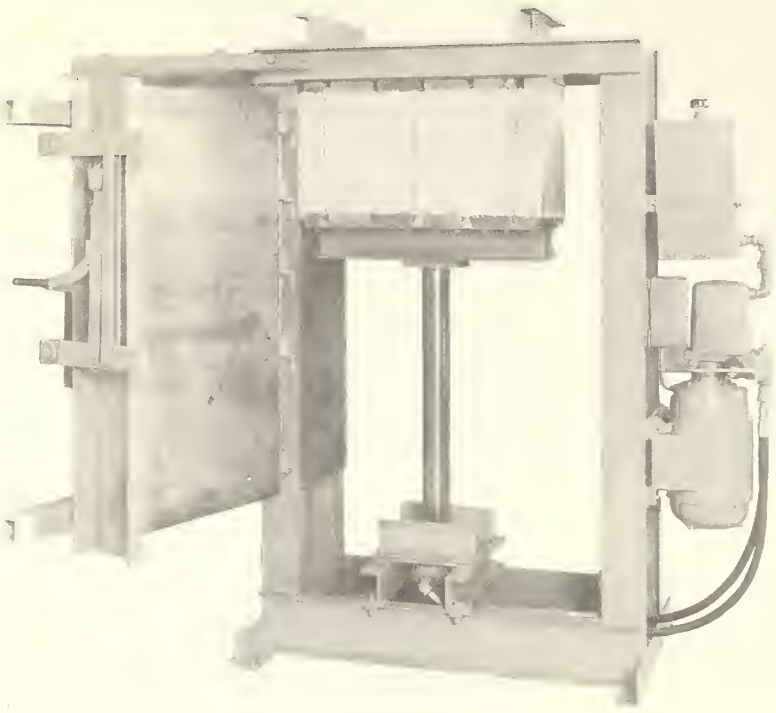

Figure 9.--An upstroke hydraulic baling press for wood shavings. (Reproduced with permission from Consolidated Baling Machine Company.)

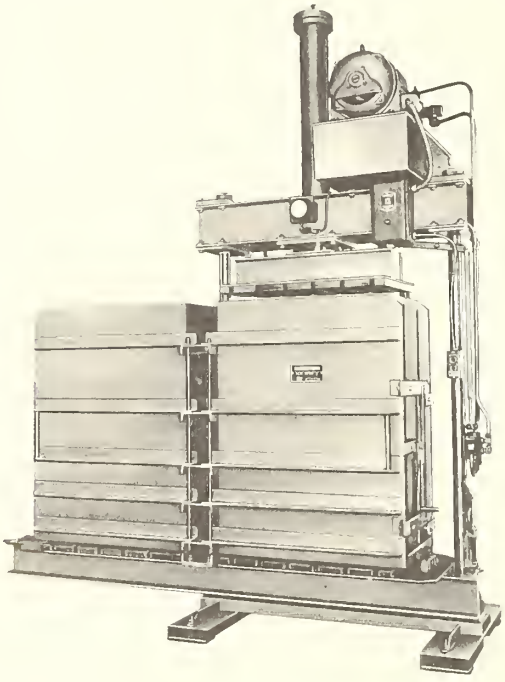

Figure 10.--Heavy-duty shavings baler. (Reproduced with permission from Consolidated Baling Machine Company.)

Figure 11.--Baled shavings stored on pallets for easy handling.

The total fixed cost of the shavings baler amounted to $2,097, or 3.1 cents per bale. Table 6 shows costs computed in the same manner as those in table 5. Variable costs accounted for about 93 percent of the total cost. An allowance of 24 cents per bale was made for raw material, but this cost may not be incurred, depending on the mill's use of byproducts.

Assuming 240 eight-hour days and a baling output of 35 bales per hour, the annual production would be 67,200 bales. This rate requires a continuous supply of raw materials, so the total production cost would be $31,625, or 47 cents per bale. Total revenue calculated at 60 cents per bale would be $40,320, leaving a return of $8,695, or 13 cents per bale.

In many mills, a production of 20,000 bales of shavings would be more practical than 67,200 bales, due to the varying supply of raw materials and size of mill. For this reason, an alternate budget based on an actual rate of 20,000 bales was constructed (table 7). At this lower production, labor costs decreased since only one man was required for 1,000 hours. Other variable costs remained constant per bale, and total fixed costs were unchanged. The reduction in bales produced and sold decreased net return to $1,343 per year.

Table 6.--Budgeted costs and returns for baling wood shavings in a typical operation with a manufactured shavings baler, 1965 prices 1/

Item	Annual	Per bale
	Dollars	Cents
Total revenue	40,320	60.0
Fixed costs:		
Depreciation:		
Machine	140	.2
Building	400	.6
Insurance	101	.2
Property tax	146	.2
Interest on investment	810	1.2
Administration and overhead	500	.7
Total fixed costs	2,097	3.1
Variable costs:		
Raw materials ($6.00/ton)	16,128	24.0
Labor (2 men @ $1.50/hr.)	5,760	8.6
Electricity (7 1/2 H.P. motor)	570	.8
Maintenance	350	.5
Other materials (wire, wood ends, etc.)	6,720	10.0
Total variable costs	29,528	43.9
Total production cost	31,625	47.0
Net return	8,695	13.0

1/ 35 bales per hour capacity, 67,200 bales per year.

Costs can be cut and net returns increased by decreasing the size of the building. Raw materials may be purchased at lower prices if there is no other demand for them.

Sawdust Sacking

Much sawdust from lumber mills is burned, apparently because these firms do not realize that sawdust can bring increased income to the lumber industry.

One firm, located in the Utah area, had a sawdust sacking operation which provided for both bulk sales and sacking. Table 8 shows the budgeted costs and returns for a sawdust sacking operation with a capacity of 192,000 sacks. Yearly operation entails sacking 100 sacks per hour, weighing 30 pounds each, for 240 eight-hour days.

Table 7.--Budgeted costs and returns for baling wood shavings for a typical operation using a specialized shavings baler operating at less than capacity, 1965 prices 1/

Item	Annual	Per bale
	Dollars	Cents
Total revenue	12,000	60.0
Fixed costs:		
Depreciation:		
Machine	140	.7
Building	400	2.0
Insurance	101	.5
Property tax	146	.8
Interest on investment	810	4.0
Administration and overhead	500	2.5
Total fixed costs	2,097	10.5
Variable costs:		
Raw materials ($6.00/ton)	4,800	24.0
Labor (1 man @ $1.50/hr.)	1,500	7.5
Electricity (7 1/2 H.P. motor)	160	.8
Maintenance	100	.5
Other materials (wire, wood ends, etc.)	2,000	10.0
Total variable costs	8,560	42.8
Total production cost	10,657	53.3
Net return	1,343	6.7

1/ 20 bales per hour, 20,000 bales per year.

The building accommodating the sacking operation, including bin, hopper, and storage area, was estimated to cost $10,000 with an expected life of 25 years. Another capital investment item was a sewing machine, costing $300, with a 10-year expected life, to fasten tops of filled sacks. Total capital investment in the budgeted facility was $10,300.

A fixed cost of 1 cent per sack was calculated for the above output. Variable costs in the operation amounted to 19 cents, bringing the total cost per sack to 20 cents. The selling price was estimated to be 30 cents a sack, so the net return per sack was 10 cents.

To produce 192,000 sacks of sawdust, a firm would need 2,880 tons of sawdust. This quantity would require sawdust from a mill producing about 15 MMbf of lumber annually.

Table 8.--Budgeted costs and returns for a sawdust sacking operation, 1965 prices 1/

Item	Annual	Per sack
	Dollars	Cents
Total revenue	57,600	30.00
Fixed costs:		
Depreciation:		
Machine	30	.02
Building	400	.21
Insurance	77	.04
Property tax	111	.06
Interest on investment	618	.32
Administration and overhead	500	.26
Total fixed costs	1,736	.91
Variable costs:		
Raw materials ($6.00/ton)	17,280	9.00
Labor (2 men @ $1.50/hr.)	5,760	3.00
Maintenance	130	.06
Other materials (sack, string, etc.)	13,440	7.00
Total variable costs	36,610	19.06
Total production cost	38,346	19.97
Net return	19,254	10.03

1/ 100 sacks per hour capacity, 192,000 sacks per year.

A firm producing about 67,200 sacks of sawdust annually may be more realistic, as this is the modal mill size in the areas (table 9). This operation would require only one man full time. At this lower rate of production, fixed costs per sack increased to 2.5 cents and variable costs to 20.4 cents, making a total cost of about 23 cents per sack. Thus, net return decreased to 7 cents per sack, or $4,725 total.

Table 9.--Budgeted costs and returns for a sawdust sacking operation with an annual output less than capacity, 1965 prices 1/

Item	Annual	Per sack
	Dollars	Cents
Total revenue	20,160	30.00
Fixed costs:		
Depreciation:		
Machine	30	.04
Building	400	.60
Insurance	77	.11
Property tax	111	.17
Interest on investment	618	.92
Administration and overhead	500	.74
Total fixed costs	1,736	2.58
Variable costs:		
Raw materials ($6.00/ton)	6,048	9.00
Labor (1 man @ $1.50/hr.)	2,880	4.28
Maintenance	67	.10
Other materials (sack, string, etc.)	4,704	7.00
Total variable costs	13,699	20.38
Total production cost	15,435	22.96
Net return	4,725	7.04

1/ 35 sacks per hour, 67,200 sacks per year.

Figures 12 to 15 show the type of equipment used by the sacking firm in Utah. The building, shown in figure 12, did not provide for storage or heating, which would be necessary for a year-round operation. Sacks were wire tied instead of sewn, although sewing is more desirable.

Figure 12.--Sacked sawdust.

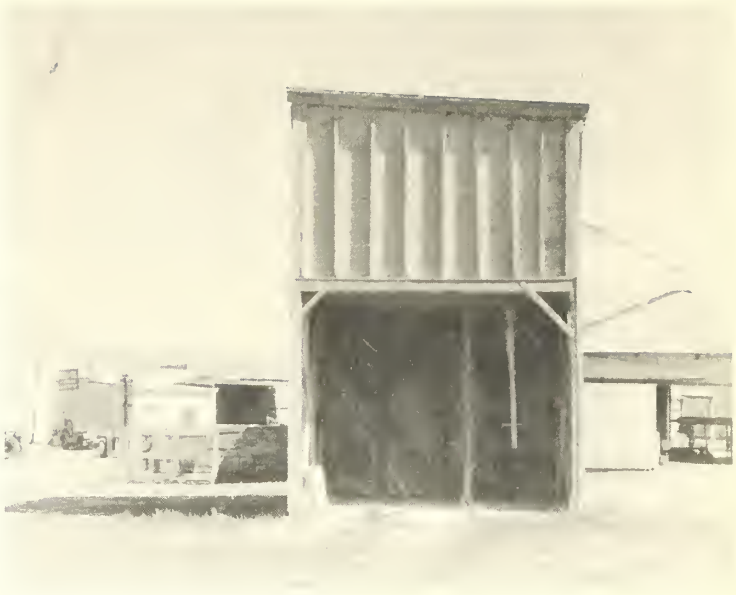

Figure 13.--Sacked sawdust facility.

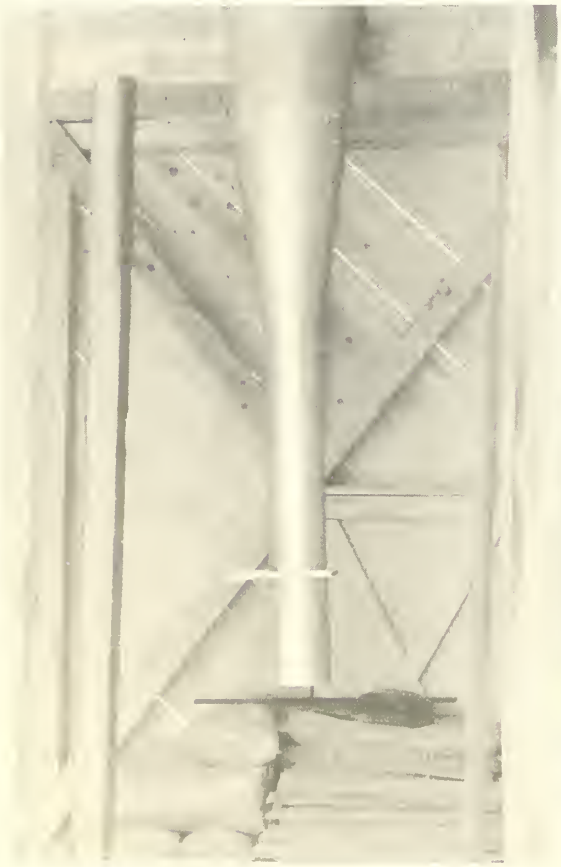

Figure 14.--Sawdust flow pipe.

Figure 15.--Manual flow control.

Combined Baling and Sacking Operation

A plant with both sacking and baling facilities can benefit from sawdust and shavings accumulated in lumber production. Such a plant could utilize all fine residue, and with some increase in capital investment could utilize much of the coarse residue. Edgings and slabs, as well as ends, can be processed into shavings and then sacked or baled. A firm in Minnesota reduced 5- to 30-inch softwood logs into shavings as its only supply of raw material for baling (3).

A plant utilizing both sawdust and shavings could operate within a single building which was budgeted at a cost of $15,000. Machinery for these operations would require an estimated capital investment of $3,800, making a total investment of $18,800.

Budgets for two levels of output were constructed: (1) A firm baling shavings and sacking sawdust which are available when 5 MMbf of lumber are produced, and (2) a firm baling and sacking at full capacity of the facilities and requiring the sawdust and shavings accumulated when 15 MMbf of lumber are produced (table 10). At capacity, net return on the second example amounted to $28,840. When the production was cut to about one-third of capacity, net returns were $5,579.

Type of Ownership

Individual proprietors, partners, and corporations are all represented in the shavings-baling business. Because of the low capital investment, it is possible for an individual to finance this operation. If labor is a problem, a partnership may work best when both partners are employed full time.

Lumber mill owners can construct baling and sacking facilities very economically. Many mills have extra land and sometimes building facilities that are not presently being used. If this is the case, the fixed cost for land and buildings may not be an added cost to the owner. Raw materials will not be an expense unless a higher economic opportunity exists for their use. Also, labor may be utilized more efficiently so that labor costs will not be as high as those indicated in the baling and sacking budgets. Advertising and selling can be handled in conjunction with going business, thus cutting this cost.

Table 10.--Budgeted costs and returns for a combined shavings-baling sawdust-sacking operation for mills with two levels of annual output, 1965 prices

Item	Annual production	
	One-third of capacity 1/	Full capacity 2/
	Dollars	Dollars
Total revenue	32,160	97,920
Fixed costs:		
Depreciation:		
Machinery	170	170
Building	600	600
Insurance	141	141
Property tax	203	203
Interest on investment	1,128	1,128
Administration and overhead	700	700
Total fixed costs	2,942	2,942
Variable costs:		
Raw materials ($6.00/ton)	10,848	33,408
Labor ($1.50/hr.)	3/ 5,760	4/ 11,520
Electricity (7 1/2 H.P. motor)	160	570
Maintenance	167	480
Other materials 5/	6,704	20,160
Total variable costs	23,639	66,138
Total production costs	26,581	69,080
Net return	5,579	28,840

1/ 5 MMbf of lumber, 20,000 bales, 67,200 sacks.
2/ 15 MMbf of lumber, 67,200 bales, 192,000 sacks.
3/ 2 men employed full time.
4/ 4 men employed full time.
5/ Includes wood ends, wire, sacks, etc.

LITERATURE CITED

(1) Corder, S. W.
1956. Oregon Mill Residues in 1953. Oreg. State Univ. Forest Prod. Lab., Inform. Cir. 7, May.

(2) Gray, James R.
1962. Economics of Sawmill Operations in New Mexico. N. Mex. State Univ. Agr. Expt. Sta., Bul. 465, June.

(3) Northern Pacific Railway Co.
1965. Northwest and its Resources. No. 3, Vol. 34, May-June.

(4) U. S. Agricultural Research Service
1965. Decomposition of Wood and Bark Sawdust in Soil, Nitrogen Requirements and Effects on Plants. U. S. Dept. Agr., Tech. Bul. 1332, May.

(5) U. S. Forest Service
1965. Timber Trends in the United States. U. S. Forest Serv. Rpt. 17, Feb.

(6) Williams, E. L.
1964. The Sawmilling Industry of Northern Idaho. Univ. Idaho, Agr. Expt. Sta., Bul. 430, Oct.

UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

Postage and Fees Paid
U.S. Department of Agriculture

OFFICIAL BUSINESS